

BONUS ASSIGNMENT  
NYA ELECTRO  
WINTER 2012

- ① THE voltage across a  $5\mu F$  is 0. WHAT IS THE VOLTAGE AFTER 20ms IF A 75mA CHARGES THE CAPACITOR.

$$\begin{aligned}V_C &= \frac{1}{C} \int i dt \\&= \frac{1}{5\mu} \int 75m dt \\&= \frac{1}{5\mu} 75m t + C\end{aligned}$$

WHEN  $t=0$   $V_C=0 \Rightarrow C=0$

$$V_C = \frac{1}{5\mu} 75m t$$

$$V_C = \frac{1}{5\mu} 75m (20m) \quad \text{at } t=20ms$$

$V_C = 300 V$

- ② A CERTAIN CAPACITOR HAS 100V ACROSS IT. AT THIS INSTANT A CURRENT OF  $i = 0.06t^{1/2}$  IS SENT THROUGH THE CIRCUIT. AFTER 0.25S THE VOLTAGE IS 140V. WHAT IS THE CAPACITANCE?

SOLUTION

$$\begin{aligned}q &= \int i dt = \int 0.06t^{1/2} dt \\&= \frac{0.06t^{3/2}}{3/2} + C_1 \\&= 0.04t^{3/2} + C_1\end{aligned}$$

(2)

$$V = \frac{1}{C} q$$

$$= \frac{1}{C} \int i dt$$

$$V = \frac{1}{C} (0.04t^{3/2} + C_1)$$

$$100 = \frac{1}{C} (C_1) \quad \text{equn 1}$$

$$140 = \frac{1}{C} (0.04 (0.25)^{3/2} + C_1)$$

(equn 2)

Solve for C :

$$140 = \frac{0.04 (0.25)^{3/2}}{C} + \frac{C_1}{C}$$

$$140 - 100 = \frac{0.04 (0.25)^{3/2}}{C}$$

$$C = \frac{0.04 (0.25)^{3/2}}{40} = 125 \mu F$$

- (3) THE CHARGING VOLTAGE FOR A CAPACITOR IS given by  $V = 0.25t^2 - 2t + 5$  volts . Determine the AMOUNT OF MAX MIN CHARGE & the time AT WHICH IT OCCURS , given

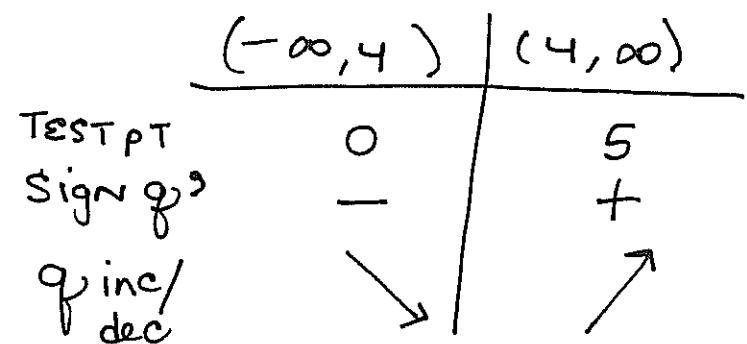
$$C = 0.1 \mu F$$

(3)

$$V = 0.25t^2 - 2t + 5$$

$$V = \frac{q}{c} \quad \text{so} \quad q = cV \\ = 0.1\mu(0.25t^2 - 2t + 5) \\ q' = 0.1\mu(0.5t - 2)$$

critical point  $\rightarrow t = 4 \text{ s}$



$q$  is a minimum at  $t = 4 \text{ s}$

$$q = 0.1\mu(0.25(4)^2 - 2(4) + 5) \\ = 0.1\mu(1) \\ = \boxed{0.1\mu c}$$